MULTIMEDIA UNIVERSITY

STUDENT ID NO

					4	5	1	1	1

Seat No.: | | | |

Venue: _____

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

TCP2101 – ALGORITHM DESIGN AND ANALYSIS

(All sections / Groups)

19 OCTOBER 2019
2.30 p.m. – 4.30 p.m.
(2 Hours)

Question No.	Marks
1	
2	
3	
4	
Total	

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 8 pages with 4 Questions only.

2. Answer **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers CLEARLY in this Question paper.

QUESTION 1

a) We can use either one of the two techniques below for analyzing the running time of an algorithm. Describe each of them and state one limitation in each technique.

- Experimental Study
- Theoretical analysis

[3 marks]

b) Given the sum of arithmetic sequence below, what is the Big-Oh notation for the function, $f(n)$?

[2 marks]

$f(n) = 3 + 3^2 + 3^3 + \ldots + 3^n$ where $n = 1, 2, \ldots$

c) Insert the numbers in the following order: 8, 27, 34, 30, 46, 62, 17, 126, 50, 32 into a Hash Table with the Hash function, h(k) = k % 16. Use linear probing to overcome the collisions in the Hash Table. [Instruction: Fill the numbers into the boxes below.]

[3 marks]

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

*Show your calculation here.

Continued...

d) Both Chaining method and Probing method are used to solve for the collisions in Hash Table. List down two (2) differences between the methods.

[2 marks]

Chaining method	Probing method

QUESTION 2

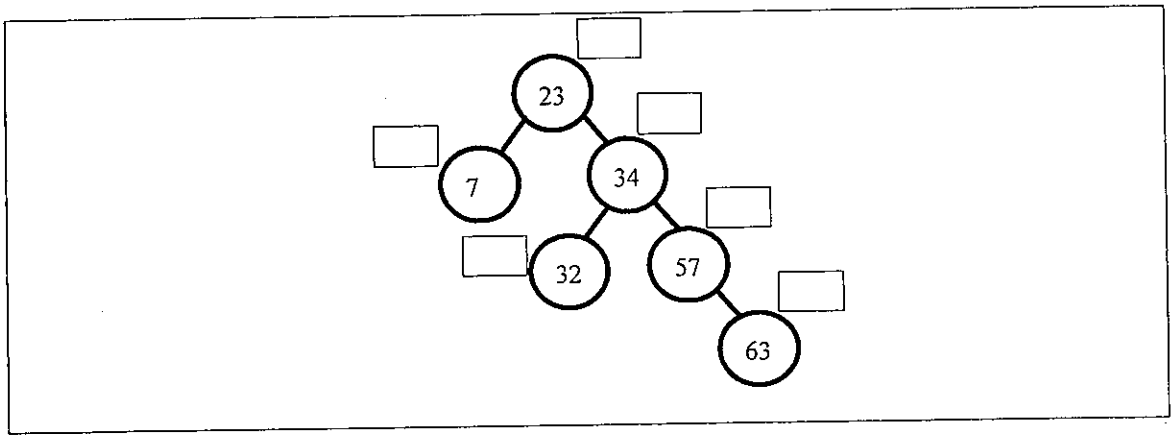
a) Given a sequence of numbers below, draw a Binary Search Tree (BST) by inserting the numbers.

15, 13, 19, 8, 5, 16, 34

[3 marks]

b) Fill in the empty rectangles with the balance factor. Which node causes the BST **not** an AVL tree (or is **not** a balance tree)?

[2 marks]



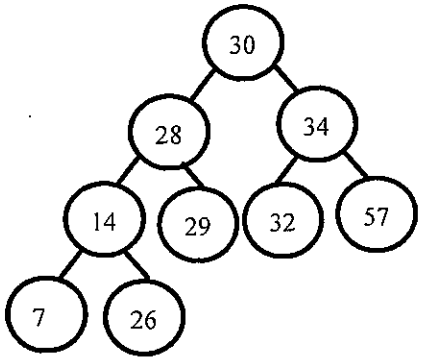
Continued...

c) Apply rotation to convert the unbalance tree in Question2(b) to an AVL tree.

[3 marks]

d) Convert the following initial tree to a max heap tree.

[2 marks]

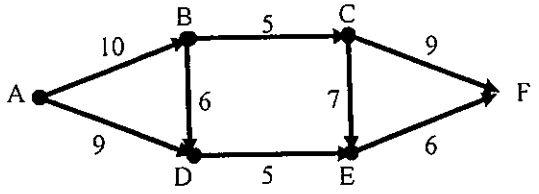


Continued...

QUESTION 3

a) Find the Adjacency Matrix and Adjacency List for the graph below:

[4 marks]



Adjacency Matrix: Adjacency List:

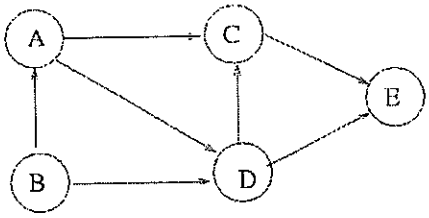
b) Define the following terms.
- Depth-first search
- Breadth-first search
- Topological sorting

[1.5 marks]

Continued...

c) Find the order of the elements in the graph below if the Topological Sorting method is applied.

[1.5 marks]



d) (i) Complete the pseudo-code for the recursive QuickSort algorithm below.
(ii) What is the time complexity for an algorithm with recurrence equation as $T(n) = 8T(n/2) + n$?

[3 marks]

```
(i)
void QuickSort(arr[ ], low, high)  // low → Starting index,  high → Ending index
{
   if (                    )  // check if the low and high relationship is true
   {
        pi =                ;   // pi is partitioning index
                            ; // Recur before pi
                            ; // Recur after pi
   }
}
(ii)
```

QUESTION 4

a) Using Radix sorting method, show the steps to sort the following numbers.

249, 458, 391, 352, 822, 423

[3 Marks]

Continued...

b) Given a knapsack problem that has seven (7) objects. Each object has its own profit and weight as shown in the table below.

Object	A	B	C	D	E	F	G
Profit	20	34	15	6	35	40	50
Weight (kg)	4	2	5	6	7	2	10

You are permitted to take the fractional amount of the object. Compute the maximum total benefit with the weight not more than 20kg. Show the selected objects and the total benefit obtained.

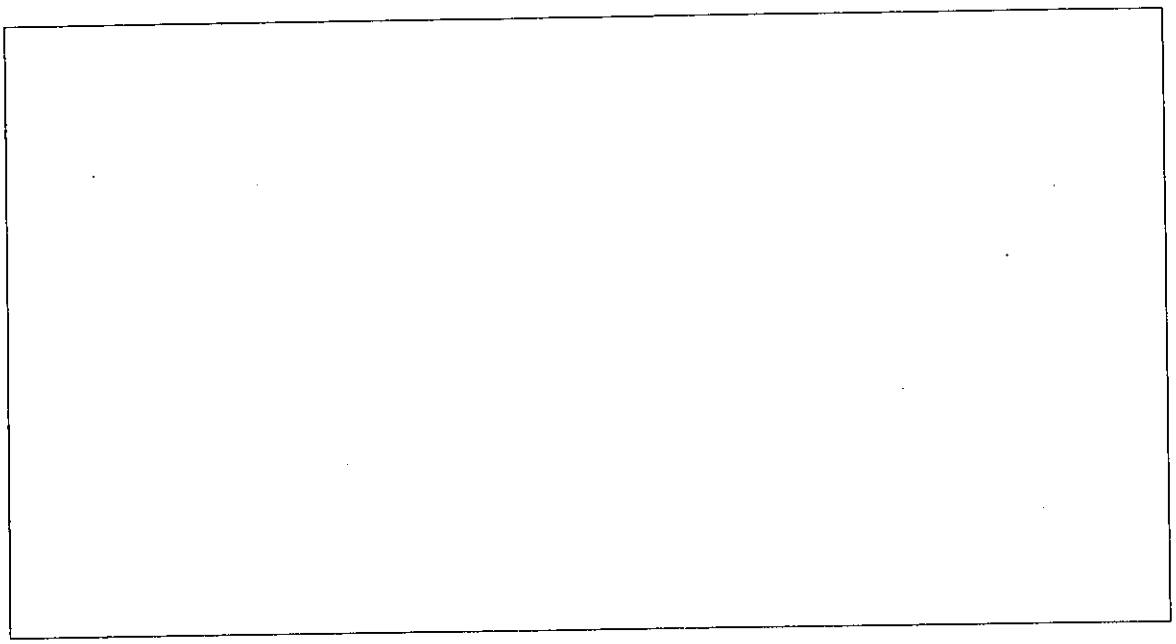
[3 marks]

c) Assume that a string Z contains the characters A, B, C, D, E and F (shown in the table below), and the frequency of each character. Compute the number of bits required to encode the string Z using Huffman Encoding.

[3 marks]

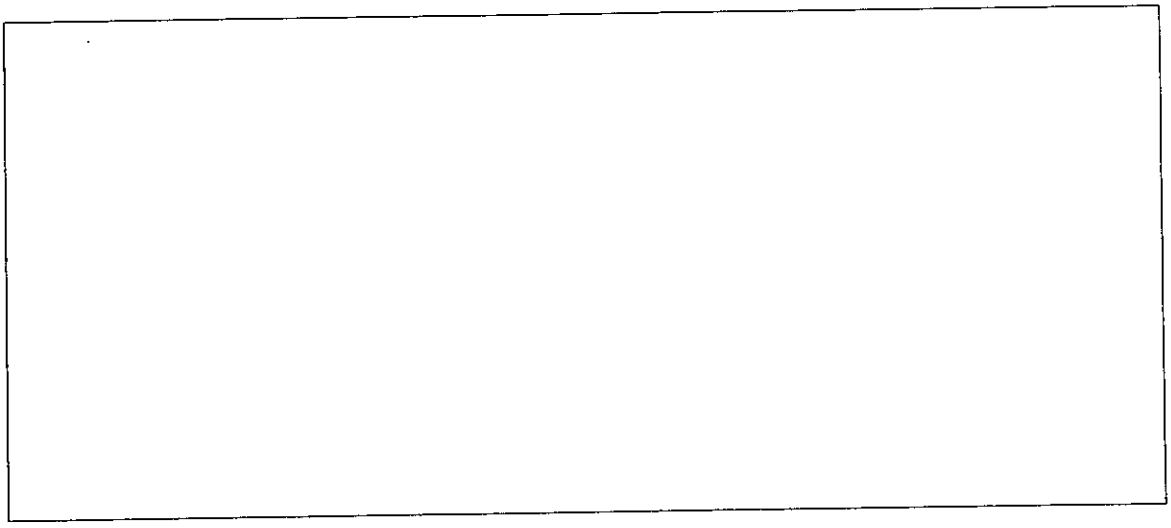
Character	A	B	C	D	E	F
Frequency	5	9	12	13	16	45

Continued...



d) What is NP hard and NP complete problem? Explain.

[1 mark]



The End..